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E65 Active Cruise Control

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E65 Active Cruise Control

Model: E65/E66

Production: All

OBJECTIVES

After completion of this module you will be able to:

- Understand ACC operation
- Locate and Identify ACC components
- Understand displays and control for ACC

Purpose of the System

Active Cruise Control (ACC) is an extension of conventional cruise control. ACC is a comfort system which assists the driver when traveling on open highways. A radar sensor monitors the distance, angle and speed of moving objects in front of the vehicle and strives to maintain a fixed distance behind the object. Vehicle ranging and speed control are achieved by means of engine management (Cruise Function of DME) and brake intervention (DSC).

The driver can preselect a desired speed and choose between 4 following distances (expressed in time intervals).

Note: Vehicles with ACC do not have “Normal” Cruise control. If the ACC system fails or enters a fault mode the vehicle does not default to “Normal” Cruise.

Safety Notice!!!

ACC is not an impact protection system and CANNOT warn against or prevent collisions. The driver must continue to intervene in critical situations.

System Components

The ACC system consists of the following components:

- Sensor-Control Module Unit
- Steering Column Stalk Switch



- Instrument Cluster Display



Instrument Cluster Display

The instrument cluster display is responsible for visual indication of ACC operation.

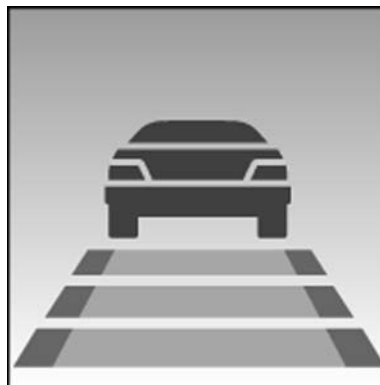
1. Indicator for stored desired speed
2. Indicator for detected vehicle
3. Indicator to show selected following distance
4. Digital speed display

Note: 1, 2 and 3 are shown when the system is active. 4 is shown for a short time when the desired speed is input.



Vehicle display is outlined:

System is active and no vehicle in front is detected.



Vehicle display is solid:

System is active and vehicle in front is detected.



Take over request:

Vehicle display is in triangle and flashes:

Driver should intervene by braking or taking evasive action as required. ACC cannot set following distance.

Principle of Operation

ACC is a Comfort function and **NOT** a Safety function.

The driver alone is responsible for the use of the ACC system including:

- Speed Selection
- Following Distance
- Acceptable weather conditions including visibility and road conditions for cruise operation

The system can be overridden at any time by the driver. Accelerating does not deactivate the system. Braking results in system deactivation.

All stored information, speed and following distance, are reset with every key activation. ACC is also reset in the case of non ACC requested DSC intervention.

The ACC system controls the following distance and cruise speed when the vehicle is traveling between 20 mph and 110 mph.

Operation

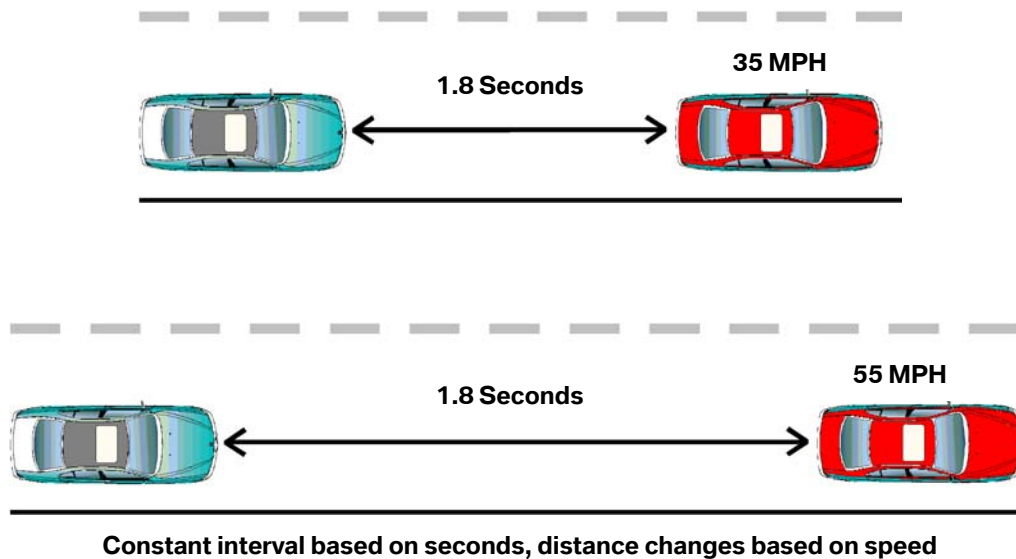
If there is no object in front of the vehicle, the ACC system operates as a normal cruise control. The desired speed input by the driver is regulated.

When an object is detected within the lane the ACC illuminates the object sensed indicator. If the object being followed is traveling at a slower speed than is set by the cruise control, the vehicle speed will be adapted (slowed) through either DME or DSC intervention to maintain the requested follow distance (timed in seconds).

The distance to the lead object will vary with the time interval chosen by the driver and vehicle speed. The speed of the vehicle will never exceed the preset cruise request of the driver.

When the object is no longer in front of the vehicle, the preset speed request will be resumed.

Note: The ACC will only detect moving objects. Objects that are stationary (stopped) will be ignored.



To maintain proper follow distance the ACC system must be able to perform the following tasks:

- Detect lead objects by radar sensing up to a distance of approx. 120m.
- Measure the distance, angle and relative speed of the lead object.
- Calculate in advance the presumed vehicle course.
- Select the relevant lead object for vehicle to object ranging.
- Adapt the actual vehicle speed to that of the lead object by:
 - Accelerating (Maximum acceleration rate 1.2 m/s².)
 - Decelerating (Maximum deceleration rate 2.0 m/s².)
- Monitor Lateral Acceleration (Maximum lateral acceleration 3.0 m/s².)

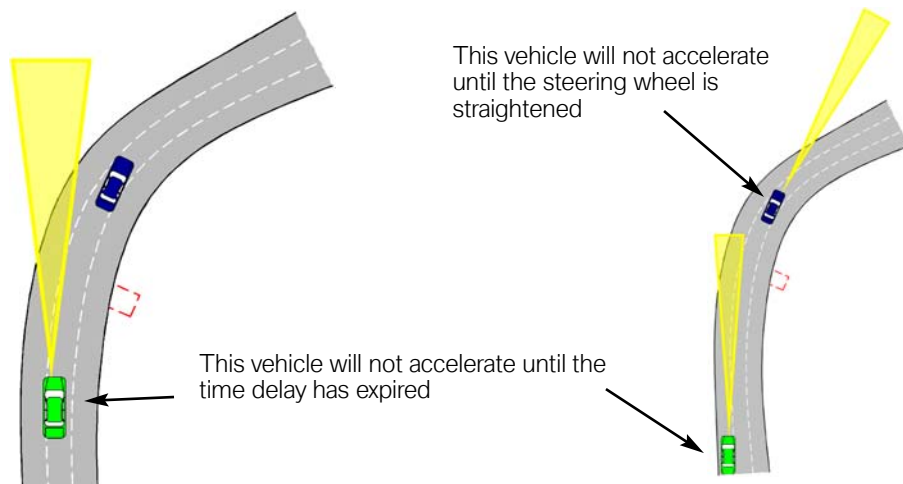
Deceleration

The ACC is only able to make limited relative speed corrections. The Maximum deceleration rate is 2.0 m/s² (**about 20% braking capacity**). When the system has reached its function limits, the driver is requested to intervene by the flashing indicator.



Side Visual Range

Because of the limited side visual range, the leading object may be lost around curves. The ACC vehicle will not accelerate to the preset requested speed as long as the steering wheel is turned and curve recognition is active. After exiting the curve a time delay is in effect to prevent rapid overtaking of the lead object.



Lane Prediction

In order to select the correct lead object for vehicle to vehicle ranging, the ACC must predict the future lane or path of the vehicle (ACC vehicle).

Lead objects are then relevant to a control operation when they are located in the actual lane. Lane prediction is an advance calculation of the actual lane of travel.

The DSC unit provides vehicle speed and the Yaw sensor driving dynamics for the advance calculation.

Limitations

The following limitations are in effect during ACC operation:

- Operation possible only between the speeds of 20 mph and 110 mph.
- Maximum deceleration rate 2.0 m/s².
- Maximum acceleration rate 1.2 m/s².
- Maximum transversal acceleration rate 3.0 m/s².

ACC reaches its limitations in the following situations:

- The sensing range of the radar sensor limits the detection of objects that are traveling in front in different lanes or around curves.
- An object cutting in results in delayed ACC responses. Do not use ACC on winding roads or if frequent lane changes occur.
- High speed differences cannot be corrected.
- ACC cannot brake the vehicle to a complete standstill. The driver must assume control of the vehicle by braking.
- ACC must only be used when visibility is adequate.
- If the time gap to the lead object is less than 1 second, especially in the case of the lead object cutting in close to the front of the vehicle, ACC may not sense the lead object in time for intervention, driver intervention is required.

Activation Conditions

The following preconditions must be met for ACC to become operational:

- Engine speed > 512 RPM
- No failure of Irreversible faults present in ACC
- ACC system “ON”
- Driving Speed > 20 MPH
- Park, Reverse or Neutral not engaged
- Parking brake not engaged
- DSC not active

Deactivation

The ACC is deactivated in several ways:

- Raising or lowering of the Stalk Switch
- Pressing the brake pedal
- Placing the transmission in Neutral
- Deactivating the DSC System
- Failure of one of the subsystems (Automatic Deactivation)
- Sensor Blindness (Automatic Deactivation)
- Vehicle speed drops below the minimum operating range (Automatic Deactivation)
- The DSC is active beyond a preset time threshold (Automatic Deactivation)

Lens Heater

The lens of the ACC sensor is heated to ensure better operation in winter and adverse conditions. The heating coil is integrated into the plastic lens body.

Lens heating is temperature dependent as measured by an internal temperature sensor in the ACC unit.

Despite the heater it is not possible to prevent sensor “Blindness” in all conditions.

Faults with the lens heating system are registered in the ACC unit fault memory.

Alignment

It is essential that the sensor be correctly aligned for proper system operation. Horizontal mis-alignment will result in erroneous reaction to objects in a neighboring lane or a delayed reaction to objects in the same lane.

ACC can compensate for minor horizontal misalignments up to 10, with slight function impairments. In the event of more serious deviations, ACC will shut down and not be available for operation.

The alignment procedure is only possible with the DISplus or the GT1 and the special tools for ACC adjustment (PN 81-10-0-021-292). Also needed is 90 88 6 361 100 KDS adapter.

Note: The tool is used in conjunction with other BMW special tools. Refer to SIB B04 03 02. Always refer to the latest bulletins and repair instructions.

ACC sensor requires alignment if customer complaints are received regarding target acquisition, an alignment error is stored in the fault code memory or the sensor has been replaced.

Preconditions

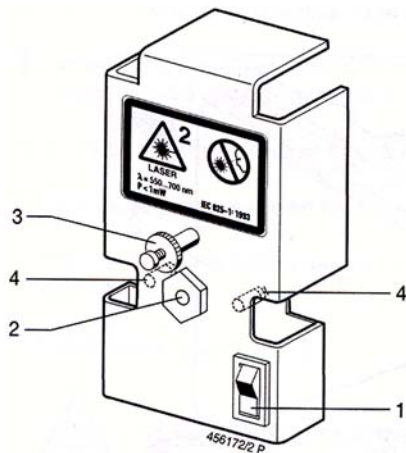
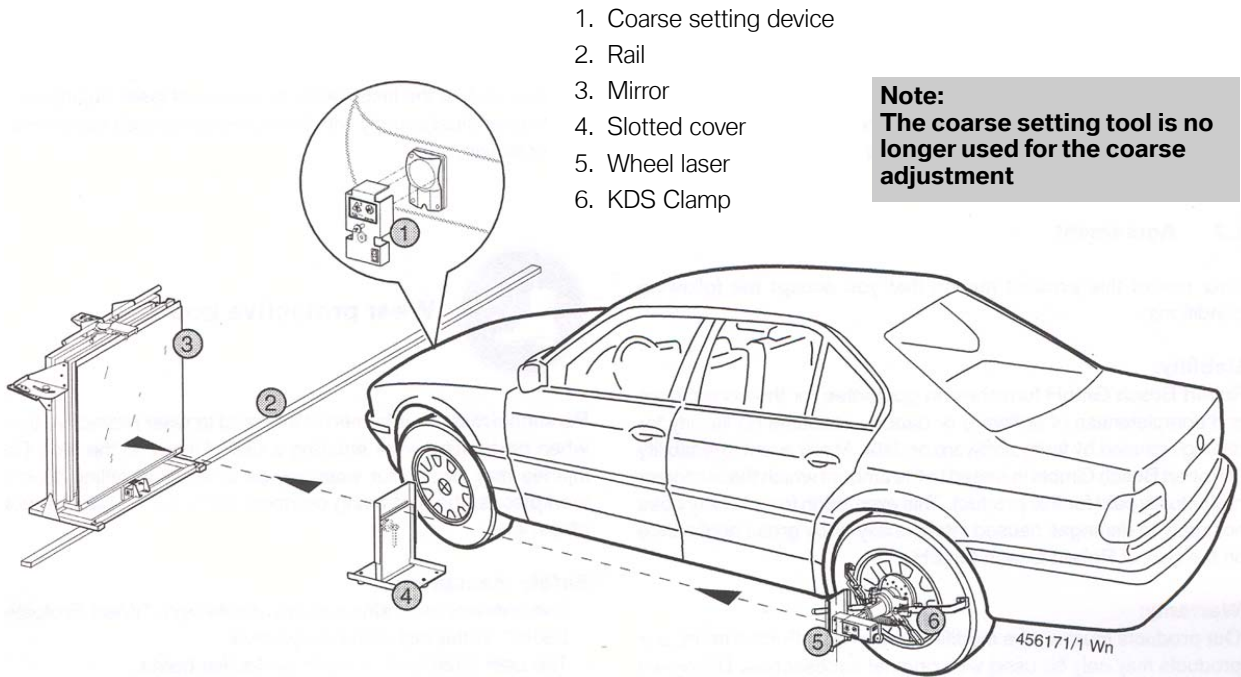
Before the alignment procedure may be carried out, certain preconditions must be met.

- Guides Rails mounted to floor for mirror positioning.
- ACC is ONLY aligned with the BMW special tool package for ACC alignment.
- Vehicle must be proper distance from mirror,
- Vehicle chassis must be in proper alignment (Particularly in case of accident repair).
- Tire pressures must be set to proper specification.
- Ride height must be in nominal specs.
- ACC sensor must be clean.
- Guide Rails must be free of dirt.
- Battery charger must be connected to vehicle.

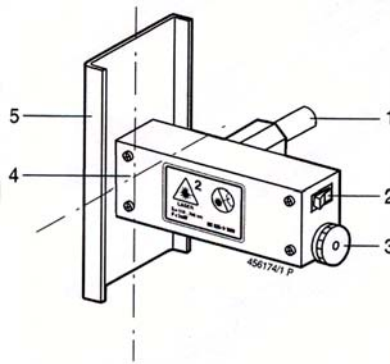
Workshop Hints

- Mark the floor for the vehicle positioning with lines for the front tire, both fore and aft and side to side. This will save time and trouble.
- Floor rail should be mounted carefully with flat head screws not round head. Round head screws interfere with the mirror unit.
- Slotted target is adjusted by the rear wheel with the slot adjusted to the height of the wheel center (using the BMW cross-hairs).
- Make certain that the alignment holes in the BMW wheels are clean and free of debris.
- If aftermarket wheels are mounted on the vehicle that do not have the alignment holes, stock BMW wheels and tires must be mounted on the vehicle prior to ACC alignment.
- All 4 wheels and tires must be factory spec sizes.
- All tires must be inflated to factory specs.
- Mount the wheel adapter securely and make sure it is straight.
- Any time the mirror unit is moved it must be leveled.
- The directions in the software refer to "front, middle and rear" mirror positions. This refers to the top mirror adjustment, which tilts the mirror.
- Read the scales carefully. A mistake here will require a complete re-do.
- Only use DISplus or GT1 CD32 and newer. Older versions will not operate correctly.
- The track must be clean for the process, which allows the mirror unit to sit properly.
- Adjustment of the sensor requires a long handled T15 torx driver.
- Adjustment increments are in 0.1 of a turn. Small adjustments work best.
- Do not lean on the vehicle at any time during the process. This could alter the results of the procedure.
- To start the test, select Service Functions, Active cruise control, Adjust ACC sensor and Test Modules.
- When asked to enter values the return (enter) button must be pressed to accept the value.
- Do not let the language of the text confuse you. The top scale is for the vertical axis and the side scale is for the horizontal axis. The test may ask you to read off the top scale, which "swivels about horizontal axis". Simply put this means that the vertical axis is adjusted by swiveling about the horizontal axis.

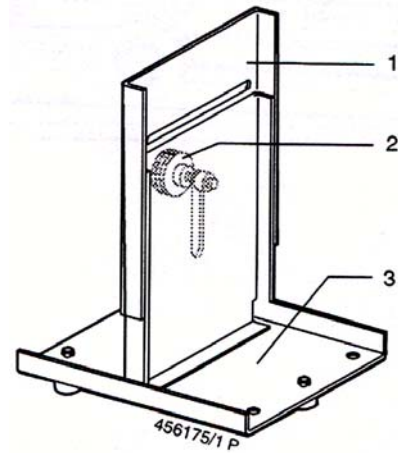
- Adjustment of the ACC sensor is the last step of the procedure. It takes 3 or 4 "Loops" to adjust the sensor to a 0 reading on the vertical and horizontal axis. A "Loop" is defined as one complete adjustment of both the vertical and horizontal axis.



1. On/Off laser switch
2. Outlet aperture for laser
3. Locking screw
4. Screws for battery compartment



1. Axle for clamp
2. On/Off laser switch
3. Cover for battery
4. Outlet aperture for laser
5. Projection surface with crosshairs



1. Height adjustable slotted cover
2. Setscrew for cover
3. Baseplate



Workshop Exercise - ACC Alignment

Alignment Procedures

Note: The function of the ACC system depends greatly on the exact setting of the ACC sensor. Meticulous care must be taken when carrying out the setting according to the instructions provided in the Test Plan. The permissible tolerance in the horizontal and the vertical direction is 0.2 Degrees.

Once the procedure has begun DO NOT lean on the vehicle.

With the vehicle properly positioned in the service bay, measure the distance from the mirror to the ACC sensor.

What is the specification for this distance? _____

Record the tire pressure specification and actual tire pressures below:

Tire Pressure	Specification	Actual
Left Front		
Right Front		
Left Rear		
Right Rear		

Adjust the laser and mirror as directed and begin making measurements.

Checklist Left Side of Vehicle			
Mirror Level Set		Slot shutter set to correct level	
Measurement of slot shutter level		Measured from?	
Value on top scale		Value entered	
Value on side scale		Value entered	

Measuring Right Side of Vehicle

Checklist Right Side of Vehicle			
Mirror Level Set		Slot shutter set to correct level	
Measurement of slot shutter level		Measured from?	
Value on top scale		Value entered	
Value on side scale		Value entered	

Adjusting the Mirror

Mirror Adjustment			
Mirror in front of ACC sensor		Mirror leveled	
Setting on top scale		Setting on side scale	
Mirror position set properly			
Adjustments required (vert)		Adjustments required (horiz)	



Classroom Exercise - Review Questions

1. How many following distances can be set with ACC?

2. Why should ACC **NOT** be used on roads with tight winding curves?

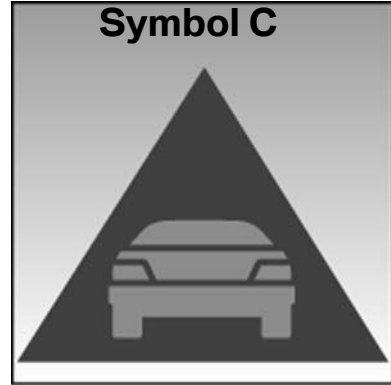
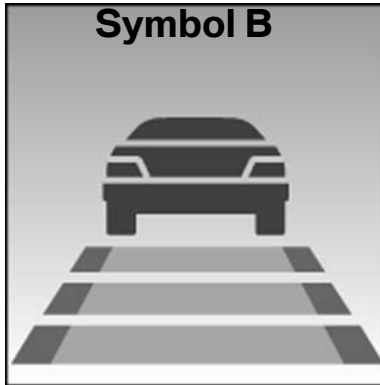
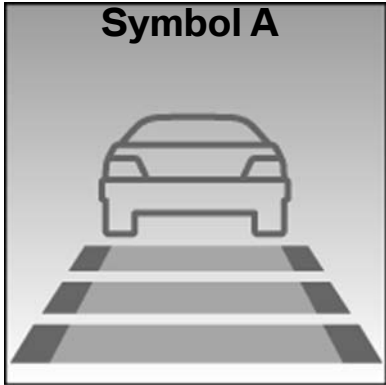
3. What are some of the pre-conditions for ACC alignment?

4. What special tools are need for ACC alignment?

5. What are the maximum/minimum acceleration/deceleration rates?



Classroom Exercise - Review Questions



6. What do the above symbols indicate?

Symbol A: _____

Symbol B: _____

Symbol C: _____

